Water Data Collection and Management Subactivity

Program	1999 Estimate	Uncontrol. & Related Chgs	Program	Program Changes	FY 2000 Budget Request	Change from 1999
Hydrologic Networks & Analysis	**25,299**	**782**	**-9,357**	**58**	**16,782**	**-8,517**
Water Information Delivery	4,229	220	-691	250	4,008	-221
Total Requirements $000	29,528	1,002	-10,048	308	20,790	-8,738

Note: The Program Redirect column reflects the redirection of funds to the Integrated Science, Science Support, and Facilities activities.

Hydrologic Networks and Analysis

Current Program Highlights

Data on the quantity and quality of water in the Nation's streams, lakes, and aquifers, as well as analytical studies, are necessary for the wise planning, development, utilization, and protection of our water resources. As the Federal Government's primary water resource agency, the USGS maintains national hydrologic networks for collecting long-term, comprehensive data on water quantity and water quality, and atmospheric deposition (such as rain and snow). The data are collected using standardized methods in all parts of the country, making the information comparable nationally. Water resource agencies, legislatures, and courts at all levels of government accept USGS data and analytical interpretations as impartial and high quality; the information often forms the basis for resolving water policy disputes and legal controversies across jurisdictional lines.

Through its hydrologic networks and analysis, the USGS provides objective information which is used to:

- respond to decrees of Federal courts, river basin compacts, and international treaties regarding water rights and allocation,
- resolve land and resource management issues in which a strong Federal interest is evident, for example, on lands owned and managed by the Federal Government,
- describe short-term or severe changes in water resources, such as flooding, droughts, and widespread contamination,
- monitor long-term changes in the availability and quality of selected streams, lakes, reservoirs, and ground water to document the current conditions and changes in these systems over time, and
- measure the quantity and quality of small streams in pristine environments to

Hydrologic Networks — The USGS operates nationwide hydrologic networks for the collection of surface-water, ground-water, and water-quality data. The funding of these networks is shared by the USGS and other Federal, State, and local agencies (see Figure W-4). The shared funding and single-agency operation

of the USGS networks provide high-quality information to all potential users, for a wide variety of uses at low cost to the Federal Government. The USGS is uniquely qualified to operate these networks because it has: (1) the expertise to develop and improve complex data-collection tools and methods, (2) the infrastructure to assure high-quality collection, management, and dissemination of data, and (3) the geographic distribution of field staff and support activities intrinsic to national networks. Because a single agency operates the networks, data are collected using nationally-accepted standardized methods, which enables comparability of data across jurisdictional boundaries and universal acceptance of results by water management agencies and courts at all levels of government.

Figure W-4

Water Quantity — At the beginning of FY 1999, the USGS operated 7,101 continuous recording streamflow stations and conducted other surface-water quantity data-collection activities as part of the National Streamgaging Program. About 445 of these streamflow stations are supported solely by Federal appropriations to the USGS through this program. Other streamflow stations are supported by more than 800 other Federal, State, and local agencies (see Figure W-5) that need the information for planning and design of bridges and other structures, water quality monitoring, reservoir operations for flood control and navigation, instream flow requirements, and flood forecasting. More than half of the streamflow stations are used as service locations or model control points by the National Weather Service (NWS) as part of their flood forecasting system. Other stations support the needs of treaties and compacts at interstate and international boundaries and provide the base information for analyzing changes in hydrologic conditions resulting from changes in land and water use or from climatic change.

The USGS uses the Federal funds appropriated through this program to support the parts of the National Streamgaging Program that are not funded by the other agencies who support stations for a specific purpose. Funds from the program support three types of stations based on the following priorities:

1. Index stations for documenting long-term flow characteristics and trends based on climatic or other natural variations. The USGS is the primary funding source for stations that are part of the Benchmark Network.
2. Stations needed for monitoring or documenting Supreme Court decrees and river basin compacts to which the United States government is a signatory.

3. Stations that are part of the NWS flood-forecasting network or that support the mission of other bureaus of the Department of the Interior or the U.S. Army Corps of Engineers. Within this category, a station has a higher priority if it supports the mission of more than one agency.

WATER DATA COLLECTION ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY

Types of Stations

Continuous record: The station is instrumented to monitor hydrologic conditions continually and, in some instances, to transmit data in near real time.

Partial record: Hydrologic information is collected only during selected periods, for example, during floods.

Scheduled, long-term: Hydrologic information is collected on a fixed schedule over a long period to detect trends. With respect to Surface Water Quality and Ground Water Levels, continuous recording stations are included in this category.

Short-term or project: Hydrologic information is collected to meet the needs of a specific study. Data supplement those available from scheduled, long-term; continuous record; and partial record stations.

Number of Stations

Column A - Stations totally supported by funds appropriated to the Hydrologic Networks and Analysis program.

Column B - Stations partially supported by funds appropriated to the Federal-State Cooperative Program subactivity.

Column C - Stations totally supported by reimbursement from other Federal agencies.

Column D - Stations supported by a combination of two or more of the above.

Types of Stations	Number of Stations As of October 1998				
	A. Federal Program	B. Federal-State Coop Water Program	C. Other Federal Agencies	D. Combined Support	Total
SURFACE WATER					
Discharge					
Continuous record	445	4,194	1,848	614	7,101
Partial record	21	2,128	305	41	2,495
Stage Only--Streams					
Continuous record	5	297	367	17	686
Partial record	0	354	37	100	491
Stage Only--Lakes/Reservoirs					
Continuous record	8	321	337	11	677
Partial record	6	128	71	0	205
Quality					
Scheduled, long-term	140	1,103	145	58	1,446
Short-term or project	362	670	119	63	1,214
GROUND WATER					
Water Levels					
Scheduled, long-term	3,851	17,075	815	29	21,770
Short-term or project	411	3,240	1,028	377	5,056
Quality					
Scheduled, long-term	455	2,039	443	0	2,937
Short-term or project	377	2,749	635	29	3,790

Figure W-5

The total resources available for streamflow gaging stations have declined steadily in recent years. This decline has resulted in a reduction of 262 stations between 1990 and 1998. Figure W-6 shows a net decline nationwide in the number of streamflow gaging stations. Changes to the streamflow monitoring network in individual States are highly variable due to changes in State funding or other Federal agency funding.

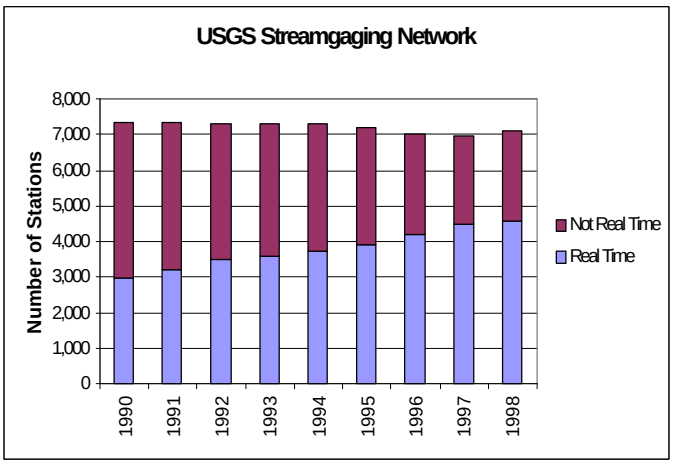

Figure W-6

Figure W-6 also shows a very positive aspect of the National Streamgaging Program. The number of stations with equipment to transmit river stage and discharge data in real-time has continued a steady increase begun in the early 1980's. This has enabled the USGS to better serve the increasing number of users of real-time streamflow data, whether they be flood forecasters and reservoir operators who make critical emergency decisions, or the fishermen and boaters who make leisure-time decisions.

Changes in technology and the changing needs of the Nation for information to assist in mitigating the impacts of floods has caused the USGS to begin reassessing its role in flood hazard mitigation. Over the past 10 years, economic losses due to flooding have averaged more than $3 billion per year. Some of the conflicting demands for USGS services that must be evaluated are:

1. Raised expectations that the USGS will disseminate near real-time flood data on the WWW. This creates a demand for more telemetry, more measurement and communications systems redundancies, and more staff time to minimize service interruptions. Improvements in flood forecasting systems by the NWS make the availability of accurate and timely streamflow data even more critical than before.

2. Increased expectations of USGS participation in flood response programs by cooperators, emergency management officials, and other customers. This includes an expectation for frequent discharge measurements and interactions with agencies that need these data. These measurements are costly and cannot be budgeted for in advance.

3. Increased direct involvement with news media and the public, answering inquiries about flood conditions.

4. Increased demands for scientific assessments of floods and the various options for modification of land use or levees in anticipation of future flooding.

5. Increased interest in the analysis of flood hazards in light of actual or potential changes in hydrology due to El Niño, land use change, water management alternatives, or climate change.

6. Increased reliance on funding partners to finance the cost of the gaging network, coupled with more restrictive rules governing project cost accounting, limiting program flexibility to deal with flood emergencies.

To explore the full range of potential changes in the USGS role in flood hazard mitigation, a National Flood Planning Committee was created in the USGS in FY 1997. Its purpose was to develop new ideas about the most appropriate role of the USGS in providing needed information before, during, and after floods. The committee continues to work to better define USGS priorities, develop approaches to improving the linkages to other agencies, and improve the reliability and quality of USGS information on floods.

At the same time, the USGS is working to further define its role in helping the Nation prepare for and manage the effects of drought. Many of the approaches that apply to flood information apply to droughts as well, although droughts do not have the time-criticality problems that are typical of floods. Planning for floods and droughts is inherently difficult because they are unpredictable events (beyond a few hours or days). These planning efforts will help to better define an approach that allocates resources in the most effective manner to help the Nation mitigate the impacts of these unpredictable hydrologic events.

Water Quality — The National Stream Quality Accounting Network (NASQAN) operates 39 stations to measure water quality and to calculate the flow of sediments and chemicals in four of the Nation's largest rivers (Mississippi, Columbia, Colorado, and Rio Grande) and their major tributaries. Data from these stations describe major ions, nutrients, carbon, dissolved and suspended trace elements, and pesticides; these data aid in the planning, utilization, and protection of these major rivers that flow across interstate and international boundaries and are the subject of complex regulatory requirements. The data also are used to determine the regional source areas for specific types of chemicals and to assess human influences on the concentrations and flow of chemicals measured. All of these rivers supply important drinking water resources from their headwaters to their estuaries. NASQAN provides the first nationally consistent data for pesticide and dissolved trace element concentration in these large rivers that uses a state-of-the-art quality assurance program to describe the quality of the data. One important customer for NASQAN data is the EPA, whose Columbia Critical Estuary Program is using NASQAN data on loadings of trace elements and pesticides. The NASQAN data play a central role in evaluation of hypoxia (low oxygen levels) in the Gulf of Mexico, providing data on the year to year variations in nutrient flux of the Mississippi River, and defining the relative importance of different source areas in the Mississippi Basin. NASQAN's large basin monitoring efforts complement the work of the USGS National Water-Quality Assessment (NAWQA) Program, which considers basins of a smaller size. Taken together, these programs are helping to describe the quality of our Nation's rivers at two different regional scales.

The Hydrologic Benchmark Network (HBN) for FY 1999 consists of 50 surface-water sites located in natural basins that are minimally altered by human influences across the Nation. Data collected at these sites fill a unique national function in discerning effects of long-term climatic trends on hydrologic systems and separating natural variability from human-induced

change in surface-water systems. The network is undergoing a technical evaluation and review of its integration with other ongoing activities, such as the ground-water level network, the NAWQA Program, and the USGS National Trends Network.

In 1982, the USGS was designated as lead Federal agency for the monitoring and assessment of atmospheric deposition (the chemical constituents deposited from the atmosphere by rain, sleet and snow). Since that time, the USGS Atmospheric Deposition Program has evolved to address the Nation's need for a long-term, high quality data base to determine spatial and temporal trends in precipitation chemistry and deposition for acidic compounds, nutrients, and base cations. The program currently provides continuous measurement and assessment of the chemical climate of precipitation throughout the United States.

- Providing Federal Leadership in the National Atmospheric Deposition Program — The National Atmospheric Deposition Program (NADP) is comprised of over 100 organizations, including eight Federal agencies, State governments, universities, tribal nations and private companies. These organizations share resources and work together to provide the Nation with a long-term, high quality database of atmospheric deposition generated from a network of 200 precipitation chemistry monitoring sites. The USGS is the lead Federal agency in NADP, coordinating Federal support of the program, and supporting 74 of the NADP-National Trends Network stations.

- Evaluating the effectiveness of the Clean Air Act Amendments (CAAA) — Current estimates for the cost of implementing the sulfur dioxide control program mandated by the CAAA are approximately $1 billion dollars per year. The program regularly provides assessments of trends in atmospheric deposition to determine if these regulatory actions are providing the desired outcome, namely an improvement in the quality of the nations precipitation chemistry with subsequent reduction in adverse environmental impacts to our land and water resources

- Determining the significance of nitrogen deposition in contributing to hypoxia — As part of a broad assessment of the low oxygen (hypoxic) zone adversely affecting productivity of ecosystems and fisheries in the Gulf of Mexico, the program is supporting the estimation of atmospheric nitrogen inputs to the Mississippi River drainage. This interpretation of monitoring data is critical to accurately gage the relative significance of atmospheric inputs of nutrients to total nitrogen loading in the basin.

- Determining the role of atmospheric deposition in soil calcium depletion in the eastern U.S. — Accumulating evidence indicates a potential for depletion of soil calcium in areas of the eastern U.S. with potentially significant consequences for forest productivity, and for the ability of surface waters to recover from acidification. Declining base cation deposition, coupled with continued acidic deposition and removal of calcium by timber harvesting has reduced exchangeable calcium pools in some forest soils to levels approaching that needed to sustain forest productivity. The data collected by the program is used to quantify the deposition of acidic materials in these regions as well as measuring the ongoing decline in atmospheric calcium deposition.

- Estimating deposition rates to sensitive high elevation ecosystems in the Western U.S. in support of Federal lands management — DOI land managers in the western U.S. use the

data collected by the program in resource impact statements and emission source permitting. Deposition to the most sensitive high elevation ecosystems in the West is not well represented by the network due to logistical problems associated with operating automated samplers at these locations. Consequently, the program supports a supplementary survey in the Rocky Mountains to measure total deposition through the use of annual snow cores.

- Supporting external use of the data by providing universal accessibility and customer tracking — All monitoring data collected by the program are available from the World Wide Web (**http://bqs.usgs.gov/acidrain/**). In 1998, data was provided to researchers, State and Federal regulatory agencies, policy makers, educators, and students. A few examples of external applications of the data include:

  - Adjusting global climate change models for enhanced carbon fixation by nitrogen deposition,
  - "Ground-truthing" atmospheric circulation models used to estimate nitrogen inputs to the Chesapeake Bay watershed,
  - Providing baseline precipitation chemistry in a study examining galvanic corrosion on F-18 fighter jets, and
  - Use by teachers and students--approximately 40 percent of all external applications of the data are for use in science education, ranging from the elementary school to graduate level programs.

Hydrologic Analysis

- Climate Variability and Change — Surface water hydrologic processes reflect the movement of moisture to, across, and from the land surface. The primary control on this moisture movement is climate which, in turn, is controlled by the general circulation of the atmosphere. Atmospheric control over surface water conditions occurs over all time scales, from minutes to millennia. The USGS is working to identify what atmospheric and oceanic patterns are most responsible for variations in hydrologic conditions (streamflow, lake levels, snowpack, and glacier mass), particularly extreme events (floods and droughts), at time scales ranging from weeks to decades. These investigations depend upon the primary surface water databases collected by the USGS, as well as modeling studies conducted in conjunction with climate modeling centers. Results are aimed at developing improved planning and management information for operators of water resource systems, as well as providing for more efficient USGS data collection operations.

- Hydrologic Science for Federal Land Management Agencies — The USGS Hydrologic Networks and Analysis Program provides water resources information to the public land management agencies of the DOI for their resource planning and management activities. One of the major activities of the program is a series of watershed modeling studies being conducted with the BOR. Two pilot studies in the Yakima River basin (Washington) and the San Juan River basin (Colorado, New Mexico, Arizona, and Utah) have used models of the hydrologic regimes of the watersheds coupled with long-term climatic data to simulate the most probable streamflow, allowing water resources managers to make decisions weeks and months in advance. A new effort begun in 1998 couples the output from general circulation models with the watershed models to provide a streamflow prediction

based on observed climate patterns. This effort is in cooperation with the National Climatic Center of the NWS.

In FY 1998, the USGS began a cost-share program with DOI agencies, as an alternative funding approach to providing hydrologic support and guidance to DOI land management agencies. Through this program, field managers are working with USGS scientists to develop and apply technically sound solutions to real-world water management issues, while sharing the funding of the work. This effort is described in the Integrated Science Activity, DOI Science Priorities Program.

- Urban Hazards Studies — In addition to the hydrologic analyses described above, this program supports an interdisciplinary urban multi-hazards effort, which is focused on earthquakes, floods, and volcanos in the Seattle-Tacoma area. Seattle is one of the communities picked by the Federal Emergency Management Agency as a Project Impact community. The Urban Hazards Initiative was designed to develop new tools in hazard assessment and loss estimation in the Puget Sound area that could be applied elsewhere. In the hydrological part of the initiative, the program has developed a technique to update flood inundation maps for the National Flood Insurance Program using new flood frequency information and digital elevation models; developed a new method to evaluate the regional flood-frequency of the Puget Lowland; and completed a tsunami-inundation model and identified potential inundation areas. Future plans for the remainder of the Initiative include preparation of maps showing potential areas of ground water flooding, related to the surficial geology, and a predictive modeling tool to identify and investigate causes of unstable streams in the five-county area.

Recent Accomplishments

Preparation Pays off in Puerto Rico as USGS River Data Keeps Flowing — Electricity was out and communication lines were cut off by the tremendous winds and torrential rains of Hurricane Georges, but thanks to good foresight in "hardening" monitoring systems by the USGS, real-time streamflow data in Puerto Rico continued to flow to reservoir operators, emergency officials, and others who need timely and reliable streamflow information. Because Puerto Rico is so often in the path of destructive hurricanes, USGS hydrologists had developed contingency operations to ensure that information on the effect of hurricane rains on local rivers would be available to those who need it. The streamflow gaging stations in Puerto Rico have been outfitted with satellite-linked data collection platforms that transmit streamflow data in real time to the main computer in the USGS Puerto Rico office in San Juan. The entire computer and data relay system in Puerto Rico is backed up with a diesel generator to ensure that information continues to flow no matter how severe the weather was. Throughout the hurricane's pass over the island, data was received into USGS computers from the backup system and data has been provided on a continuous basis to key cooperators. USGS streamflow data for Puerto Rico and other real-time stations throughout the U.S. are available to the public via the WWW (**http://water.usgs.gov**). Data are updated at 15-60 minute intervals.

Clean Air in the East — In a 1998, CENR interagency report to Congress, USGS authors reported that Phase I of the Clean Air Act Amendments Title IV has reduced acidic deposition in the eastern United States.

Acid Rain Data on the Internet — The use of atmospheric deposition data by researchers and students is growing dramatically. In 1998 approximately 13,000 atmospheric deposition data sets from the National Trends Network were provided to investigators worldwide via the Internet. This is compared to approximately 1,000 data sets provided in 1996, the first year the data was made available on the Internet.

Justification for Program Change

	FY 2000 Request	Program Change
$(000)	16,782	+58

This program change is a net change which combines several decreases and increases, as follows:

Real-Time Hazards (+$3.0 million) —The increase requested for FY 2000 would allow the USGS to purchase and install new or upgraded streamgaging telemetry at 150 gaging stations supporting high-priority river forecasting locations selected in consultation with the NWS, and purchase new velocity sensing equipment for an additional 5 gaged locations on rivers where conventional streamgaging techniques do not provide timely and reliable flood-flow information. In addition, to improve service during major floods, the USGS will enhance its ability to estimate streamflow from water levels (stage-discharge ratings) at approximately 50 gaging stations where existing ratings are inadequately defined and do not permit accurate forecasting of extreme floods. Finally, the USGS will reactivate discontinued stations or strengthen existing stations at 10 vital locations.

Hypoxia in the Gulf of Mexico and the Mississippi River (+$0.4 million) — A persistent "dead zone" in the northern Gulf of Mexico develops seasonally near the outlet of the Mississippi River and westward along the Louisiana coast. Scientists believe this condition is caused by the flow of large quantities of nutrient-rich freshwater into the Gulf of Mexico from the Mississippi River each year during spring and summer. With the increase requested, the USGS will be able to expand research on hypoxia, with high priority on: (1) improving the NASQAN monitoring network to provide better spatial definition of nutrient production and response to management actions, and (2) improving scientific methods for identifying nutrient sources and the associated land uses.

Program Reductions (-$3.342 million) — Reduce funding for the USGS Hydrologic Instrumentation Facility (HIF) by recovering costs from customers for testing and developing new instrumentation for water monitoring; eliminate support for the infrastructure resources research begun in FY 1997 and seek alternate funding through the Federal-State Cooperative Water Program; eliminate funding for gaging activities in support of water-quality monitoring of the Lake Champlain basin which will be sought through alternate funding arrangements with Federal, State, and local agencies; reduce funding for watershed modeling studies that provide information and management tools to land and water management agencies; discontinue endocrine disruption studies at Lake Mead, Nevada; and completed evaluation of ground water monitoring well site in Molokai, Hawaii.